

REMARKS

Claim Objections

Claim 47 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim.

Claim 47 has been canceled.

Claim Rejections – 35 USC §112

Claims 27 – 39, 44 – 52, 54, 55, 72 and 73 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. Claims 27 and 44 recite wherein the binder is originally a water dispersible binder. However, the instant specification allegedly does not support this limitation.

The recitation that the binder is a “water dispersible binder” is fully supported in the specification. The paragraph on page 4, lines 3 – 10 of applicants’ specification discloses that *inter alia* the particulate solid lubricant is mixed with the binder in a weight ratio of about 19 : 1 to 1 : 19 of solid lubricant to binder and “mixed with water” to produce a slurry in the range about of 5 to 60 wt% solids and that “The binder is preferably hydrophilic and may be selected from the group consisting of bentonite, filler’s earth (fuller’s earth), montmorillonite and the like hydrous aluminum silicates”.

It is clear from this description that the liquid is water.

It is stated in the paragraph bridging pages 5 and 6 of applicants’ specification that *inter alia* “The most suitable inorganic binders are those that have to be stabilized at

temperatures higher than the drying temperature of the wet mixture. The low temperature processes for drying the mixtures contemplated in this invention do not stabilize the binder and the particles that fall outside the usable range can be readily reprocessed by re-dispersing the binder and solid lubricant and any filler in the liquid. Only after the right particle size cut is produced is the binder stabilized and rendered non-dispersible and ready for thermal spraying. Stabilized in this context means that the binder can no longer be redispersed in the liquid."

It is further stated on page 7, lines 16 – 19 with respect to the description of the preferred embodiments, "Product cuts 42 and 48 are passed to oven 52 and heated to at least 850°C to stabilize the binder thus rendering the particles refractory and strong and insoluble in water, the stabilized binder having the characteristics of insoluble ceramics."

The product thus is rendered no longer dispersible in water by stabilizing the binder at a temperature above at least 850°C.

It is respectfully submitted that claims 27 and 44 and the claims dependent thereon are fully supported by the specification.

Claim Rejections – 35 USC §103.

Claims 27, 29, 38, 39, 72 and 73 are rejected under 35 U.S.C. 103(a) as being unpatentable over Heath (US 3,051,586) in view of Sato et al. (US 4,233,254).

Independent claim 27 has been amended by incorporating therein "and wherein the inorganic water dispersible binder is a hydrous aluminum silicate that is stabilized at a temperature above about 850°C" taken from claim 28 which is canceled as redundant.

Heath merely teaches a lubricant coating or film comprised of organic polymer or inorganic frit binders and solid lubricants suspended in the binders sprayed directly onto substrate surfaces such as bearings or bushings subjected to mechanical friction. The binder

preferably is entirely composed a resinous plastic material, (col. 2, lines 33 – 38) i.e. organic material, and is cured by heating on the substrate (col. 2, lines 31 – 36). For bearings subjected to high temperatures, a ceramic frit provided as “any suitable conventional porcelain enamel binder” (col. 2, lines 62 – 64) may be fused onto the bearing surface at a temperature in excess of 800°F (425°C). As will be discussed below, an organic binder is completely inoperative in applicants’ process.

Accordingly, first of all, Heath relates to a spray coating process and is not pertinent at all to applicants’ process. Secondly, the statement in the Action in the sentence bridging pages 3 and 4 “Since Heath discloses the use of either an organic or inorganic binder, and furthermore since the reference does not constrain the amount of inorganic binder to any particular value, it would have been obvious to use an inorganic binder in the same amount as the organic binder absent evidence to the contrary” is not understood. The preferred composition of the reference is inoperative in applicants’ process and there is no suggestion or motivation to substitute inorganic binders in the same amount of organic binders. The fact that the reference “does not constrain the amount of inorganic binders to any particular value” does not make it obvious to substitute values of an inoperative ingredient. In addition, Heath does not teach or suggest a hydrous aluminum silicate as a binder.

With regard to Sato, et al., it is cited as a secondary reference to disclose a method to mill solid lubricant and binder mixture by pulverization to form dried particles which are classified into an undersize particle size, a desired particle size, and an oversize particle size fraction. The oversize particle size fraction is crushed to achieve the desired particle size cut. The fines are recycled by adding them back into the process. The mixture is dried at a temperature in the range of 50 to 70°C. Sato et al. use a thermosetting organic resin binder and organic solvents in which the binder dissolves to form a solution of the binder in an

organic liquid, such as a resin and/or novalak type phenol resin, or synthetic resins of the thermosetting type in a volatile organic solvent (column 3, lines 13 - 17).

It is Examiner's position that the Sato et al. drying temperatures of from 50 to 70°C are sufficient to render the binder non-dispersible. Sato et al. cure the resin binder at 120° - 300°C (col. 5, line 4). Applicants in distinction rely on their inorganic binder remaining non-dispersible during drying at temperatures above 70°C and above the Sato et al. curing temperature range of 120° - 300°C to permit redispersion of the recycle undersize and oversize particles in the water of the mixture for recycle and reuse of the particles to obviate crushing of oversize and to achieve almost 100% recovery in any desired size range cut. Applicants' inorganic binder does not stabilize, i.e. become non-dispersible in water, until heated to a temperature above about 850°C.

Applicants' invention as claimed in essence comprises admixing a particulate solid lubricant and an inorganic water dispersible binder of a hydrous aluminum silicate that is stabilized at a temperature above about 850°C in water, forming and drying particles of the mixture at a temperature below the stabilizing temperature to form dry agglomerates which remain dispersible in water, classifying the dry agglomerates by size, recycling the undersize and oversize agglomerates for redispersion in water, which allows forming, drying and classifying of fresh particles without any waste, and heating of on-size particles to render the binders non-dispersible in the water.

One skilled in the art would not be motivated to heat either Heath or Sato et al. having organic binders to a temperature of at least 850°C to render the binders non-dispersible in water as the organic binder-agglomerate would disintegrate upon heating.

Claim 27 and claims 29, 38 and 39 dependent thereon, and claims 72 and 73 relating to the product by process, are accordingly believed clearly patentably distinct over the combination of Heath and Sato et al.

Claims 31 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Heath (US 3,051,586) in view of Sato (US 4,233,254) and Dorfman et al. (US 5,506,055).

Claims 31 and 37 depend on claim 27 which is believed patentable over Heath in view of Sato, et al., as discussed above. Although Dorfman et al. is cited to teach that hexagonal boron nitride is the conventional form of boron nitride, the combined teachings of Heath, Sato et al. and Dorfman et al. do not disclose or suggest heating of on-size particles to an elevated temperature of 850°C or above to render the binders non-dispersible in water.

Claims 27 - 30, 39, 72 and 73 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brown et al. (US 4,039,337) in view of Sato (US 4,233,254).

Sato et al. has been discussed above. The temperature range of 50 to 70°C of Sato et al. to render an organic binder non-dispersible is not pertinent to applicants' temperature of 850°C or above to render inorganic binders non-dispersible in water.

With regard to Brown et al., this reference does not teach the use of hydrous aluminum silicates as a binder. The selection of hydrous aluminum silicates as a binder is not merely a matter of design choice lacking criticality within the skill of the ordinary artisan but selective production within a desired size range without waste of an agglomerate stabilized to render it suitable for thermal spraying at temperatures of 2000°C without disintegrating.

The Brown et al. reference clearly does not disclose or suggest applicants' method as now claimed in claim 27 and claims 29 - 31, 38, 45 and 46 dependent thereon or on claim 44, as discussed above, in which undersize and oversize agglomerates are recycled and

redispersed in water of the mixture for almost 100% recovery and the production of product size agglomerates of a desired close size range without crushing of oversize particles.

With regard to claim 28 and the silicate binder of Brown et al., this binder was discussed in the Response dated October 29, 2007 with reference to the Declaration of William Walkhouse, paragraph 16, which stated:

*"Applicants submit that, a person of ordinary skill in the art, being aware of US '337 (Brown), would not consider using hydrous aluminium silicate as a binder during the making of a solid lubricant agglomerate. This is because of the pronounced differences between hydrous aluminium silicate and the silicates of US '337, and how these differences affect the manner by which each of them coat components of its respective solid lubricant agglomerate. The mechanism by which hydrous aluminum silicate coats components of the solid lubricant agglomerate (being made by the method as claimed in claim 44), in comparison to the mechanism by which the silicates of US '337 coats components of the solid lubricant agglomerate, is very different. Unlike the water-soluble silicates described in US '337, hydrous aluminium silicate does not actually dissolve into solution as ions. Rather, hydrous aluminium silicate disperses into platelets which are about 300 to 500 microns in diameter, and only 3 to 5 microns thick. The hydrous aluminium platelets develop concentrated areas of cations and anions. Because of this, the individual platelets have a tendency to stick together (like overlapping playing cards) and form a very strong film on the available surface of the agglomerating components as the water is driven off. In contrast, the silicates*

*described in US '337 dissolve in water and coat the particles in US '337 by a wetting action.*

*Additionally, unlike the silicates described in US '337, the crystallographic structure of the hydrous aluminium silicate binder (of the solid lubricant agglomerate made in accordance with the method as claimed in claim 44) is modified with a post-heat treatment such that the hydrous aluminium silicate binder becomes "stabilized" and cannot be re-dispersed as platelets. In contrast, the silicate binders discussed in US '337 would remain re-dissolvable. Being able to stabilize a binder, such as hydrous aluminium silicate binder (i.e. render the hydrous aluminium silicate non-dispersible), is important for subsequent hydrometallurgical coating operations."*

In summary, the silicate binders of Brown et al. remain water soluble and can re-dissolve to form a solution containing individual molecules, as compared to platelets of applicants' hydrous aluminum silicate binders which cannot redisperse after stabilization, as required for applicants' product for use in a high temperature metallurgical coating. Brown et al. use bentonite as a setting agent, and not as a binder, to produce films and not agglomerates.

Claims 31 – 37, 44 – 55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brown et al. (US4,039,337) in view of Sato (US 4,233,254) and Dorfman et al. (US 5,506,055).

Brown et al. in view of Sato et al. have been discussed above and independent claim 27 believed patentably distinguished. The disclosure of hexagonal boron nitride in Dorfman et al. with respect to independent claims 31 – 37 does not render those claims obvious.

With regard to claims 49 – 52 and 54, the sodium silicate, potassium silicate and lithium silicate binders of Brown et al. do not function in the manner of the hydrous aluminum silicates as discussed with reference to the Walkhouse Declaration, and are not obvious variants of each other group.

Response to Arguments

In reply to Examiner Lang's comments:

- (A) Heath sprays a continuous film onto a surface of a bearing or bushing which is heated and cured for lubrication – applicants produce a sized and stabilized agglomerate product containing a lubricant which is suitable for use in a thermal spray process in which the flame temperatures are always above 2000°C (page 5, lines 13 – 18) and thus the two spraying techniques are clearly unrelated;
- (B) Applicants have clearly shown above that the Sato et al. drying temperatures of 50 to 70°C would not render applicants' binders of hydrous aluminum silicates, requiring at least 850°C to stabilize and render non-dispersible;
- (C) Applicants have shown criticality with respect to hydrous aluminum silicates, specifically bentonite, fuller's earth or montmorillonite, relative to other silicates, in the Walkhouse Declaration. Sodium silicate disclosed in Brown et al. is of a different class of silicates and is not claimed;



- (D) Sato et al. pulverize oversize agglomerates which step applicants have overcome by redispersing oversize in the liquid and reprocessing rounded agglomerates to avoid waste and to produce a non-angular product. Sato et al. clearly do not redisperse either oversize or undersize agglomerates;
- (E) hydrous aluminum silicates and sodium silicate are different classes of silicates with different characteristics as discussed in the Walkhous Declaration, and sodium silicate is not claimed.

It is believed the claims as amended comply with all formal requirements and patentably distinguish over all combinations of cited prior art references. Such favourable consideration with withdrawal of the Final Rejection and allowance of all claims are earnestly solicited.

Respectfully submitted,  
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